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# Lung Function in School Children: 1971-1972 Chattanooga Study

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# LUNG FUNCTION IN SCHOOL CHILDREN: 1971-1972 CHATTANOOGA STUDY

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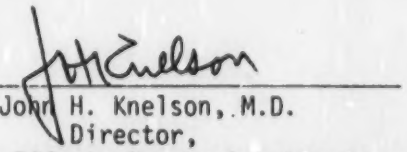
This particular epidemiologic study was conducted as part of the Community Health Environmental Surveillance System (CHESS). Lung function was used as the health indicator because previous studies suggested that this measure is sensitive to air pollution. Chattanooga was chosen because of its unique high ambient $NO_2$ air pollution exposures.



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## ABSTRACT

Previous studies of lung function in children have indicated that decreases in lung function are associated with higher air pollution exposures. For this reason, three quarter second timed forced expiratory volume was chosen as one of the health indicators in the Environmental Protection Agency's Community Health Environmental Surveillance System (CHESS). The city of Chattanooga, Tennessee was chosen because of its exposure to a large stationary source of nitrogen dioxide. The present study, conducted in 1971-1972, was a follow-up to an earlier study performed by Shy, et al. in 1968-1969. The present study did not confirm the slight differences found in the earlier study. This might be explained by the reduction in $NO_2$ levels since the 1968-1969 study.

## ACKNOWLEDGMENTS

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# INTRODUCTION

Significant decreases in lung function early in life may be a risk factor for later respiratory disorders. Previous studies in Japan, Great Britain, Italy and North America report decreased lung function in children living in areas of high air pollution.[1-6] Based on these findings, lung function in school children measured by three-quarter second forced expiratory volume ($FEV_{0.75}$) was selected as a health indicator in the Environmental Protection Agency's Community Health Environmental Surveillance System (CHESS). Highly significant decreases in lung function have been noted with aging, chronic obstructive lung disease, and cigarette smoking.[7] Ceasing cigarette smoking lessens chronic respiratory disease symptoms.[8] Therefore, reducing ambient air pollution might improve lung function, and decrease risk of chronic respiratory disease from previous elevated air pollution exposures.

The present study primarily investigates the effects on a community exposed to a large stationary source of atmospheric nitrogen dioxide ($NO_2$). The source, the Volunteer Army Ammunition Plant, is located in Hamilton County, Tennessee, just beyond the northeastern fringes of the city of Chattanooga. A substantial proportion of trinitrotoluene (TNT) produced in the United States was manufactured at this plant, which operated only during World War II and the Korean and Vietnam conflicts. Shy, et al,[9] conducted a similar lung function survey in Chattanooga in 1968-1969. Since that time, however, air quality in the plant vicinity has improved due to pollution control and decreased TNT production. This study, a follow-up of the 1968-69 survey, was designed to test the hypothesis that early childhood exposure to ambient $NO_2$ air pollution reduces lung function in later childhood. A similar lung function study of New York City children exposed to increased sulfur oxide and particulate air pollution in early childhood suggests that effects are still observed in later childhood, although current pollution levels had been greatly reduced.[10] Rejection of the above hypothesis would indicate that reduction in ambient $NO_2$ air pollution may lead to improvements in lung function.

## METHODS

### FEV Measurements and Covariates

Three geographic areas (or communities) each containing three elementary schools were selected from Hamilton County, Tennessee: (1) Red Bank, a control area three to five miles north of downtown Chattanooga, representing low exposure to $NO_2$; (2) Brainerd, a low to intermediate exposure area east of downtown Chattanooga; and (3) Harrison, the area nearest the plant, with previous high exposure to $NO_2$. These areas are shown in Figure 1. Within each community, children in the elementary schools were enrolled for the study. Most children resided within one and one-half miles of at least one centrally located air monitoring station. The three communities are geographically close enough to experience similar meteorologic conditions so explicit adjustment for differences in meteorology was not necessary. A total of 5589 children participated in the study. Each child's age, race, and sex were obtained from school records. The analyses however, were restricted to whites, since ethnic differences could have biased the study. In particular, blacks have been shown to have lower measured lung function than whites of comparable age, sex and height.[11-14] Of the 4880 white children, 150 reporting asthma during the study were deleted. Children with insufficient or no age and sex information were also deleted, leaving 4704 children in the basic analysis file. Deletions are detailed in Table 1. Age distributions by sex and community are shown in Table 2 for children in the basic analysis file.

A family health questionnaire distributed in January, 1971 to the parents of the study's children obtained information on smoking habits, educational level of the parents, and length of residence. This questionnaire was the same type described in Health Consequences of Sulfur Oxides: A Report from CHESS 1970-1971.[15] Information is summarized in Tables 3 and 4 for families in the basic analysis file who returned the questionnaire. There was no indication of educational differences by community. The fathers showed slight smoking differences by community, but the differences showed no pattern. The mothers had similar smoking habits across all three communities. Though the smoking habits of elementary school children were not documented, there was no particular reason to suspect that their smoking habits would be very different in the high and low pollution areas. The prevalence of cigarette smoking among children is probably most strongly influenced by parental smoking habits and these were shown to be relatively similar. Table 5 shows the length of residence in Chattanooga for all 3 communities. Although there were differences by community, a majority of the families in each community had lived in the city for 12 or more years. Eighty percent of the families had lived in the city for at least four years, which includes the periods of elevated exposures. Thus the effects of migration should be minimized in this study.

The three-quarter second forced expiratory volume ($FEV_{0.75}$) test was performed in the schools. Two rounds of testing were conducted: in winter (February-March 1972) and in spring (April-May 1972). Just before testing,

children received an introduction and test demonstration, which emphasized maximal inspiration first, then expiration, as forceful and complete as possible, into the spirometer. Each child was tested until three valid FEV measurements were obtained. Since the $FEV_{0.75}$ is effort dependent, the maximum of each child's three readings was used in data analysis. At the time of testing, each child also reported the presence or absence of a cough, cold, sore throat, or asthma.

All tests were performed with a 12-liter bellows-type spirometer manufactured by Cardiopulmonary Instruments, Inc. (CPI). In this instrument, expired air displaces a cylinder whose air seal is a pliable rolling diaphragm. The mechanical displacement of a piston over 0.75 second is transduced to a voltage which is displayed, as $FEV_{0.75}$, on a nixie-tube digital readout. The CPI instrument was calibrated before testing against both a Collins water-filled spirometer and 1.5 liter syringe. Several times each testing day, the linearity of the digital readout was checked. All raw $FEV_{0.75}$ readings from the CPI instruments were converted to body temperature and pressure, saturated conditions (BTPS).

The 4704 elementary school children included in the basic analysis file were analyzed separately by age, sex, and season. An age cut was made at 9 years (108 months) because the relative effects of age and height on lung function appear to change near this age.[10] Each analysis required deletions for inadequate information, summarized in Table 1. The FEV's were required to be between 0.4 and 4.0 liters. The heights were restricted to a range from 30 to 72 inches. If any of the variables were missing, or outside the indicated ranges, that observation was deleted from the analysis.

The statistical analyses were made using a general linear model.[16] The particular model which was chosen allowed for a linear effect of standing height and age, as well as for community and machine differences. A dichotomous variable was also included to indicate a cough, cold or sore throat. The tests of significance can be thought of as a test of the effect of a particular variable above and beyond the effect of all other variables. This procedure can be conservative, if the independent variables are highly correlated. In this case, the factors of age, height and machine are independent of community and symptom, and so the tests for community differences or symptom effect should not suffer from this problem. The means shown in the analysis tables (Tables 15 and 17) are adjusted for age and height differences.

## Pollutant Exposures

Air pollution exposures were constructed with data from five sources: (1) local monitoring done at the 9th street and Georgia Avenue post office, (2) averages from two stations at the Volunteer Army Ammunition Plant (VAAP), (3) Division of Abatement, National Air Pollution Control Administration (NAPCA), data used for an interstate air quality study,[17] (4) Division of Health Effects NAPCA, data used in the study by Shy, et al,[10] and (5) the CHESS network, which was installed for this and other related studies.

The 9th street post office and the VAAP data provide the only year to year comparisons of pollution levels prior to 1970. The 9th street post office data were collected using a high-volume sampler. Data from 1958 to 1972 for TSP, Nitrate, and Sulfate are shown in Table 6. The VAAP data consists of $NO_2$ measurements collected using a Technicon instrument with a Saltzman reagent. Data from two sites for the years 1968-1973 are shown in Table 7.

The $NO_2$ data collected by the Division of Abatement, NAPCA, were used for an interstate air quality study of Chattanooga, Tennessee and Rossville, Georgia.[17] The data were collected from September, 1967 to November 1968 at 10 sites. The sites are shown in Figure 2, and the data are shown in Table 8. The colorimetric Saltzman technique was used at all stations.

The data collected by the Division of Health Effects, NAPCA, are taken from the study by Shy, et al.[10] The data are shown in Table 9, with the $NO_2$ data converted to $\mu g/m^3$. The locations of the monitoring sites are shown in Figure 1. The $NO_2$ data were measured by the Jacobs-Hochheiser method, so the accuracy of the values is very questionable. This method has interference problems summarized in a paper by Hauser and Shy.[18] Both the $NO_2$ and nitrate values do show much higher levels in the Harrison area, and such differences could not likely be entirely due to the measurement method.

CHESS data were available for four pollutants: total suspended particulates (TSP), sulfate fraction of the TSP (sulfate), nitrate fraction of the TSP (nitrate), and nitrogen dioxide ($NO_2$). All of the pollutants were measured in micrograms per cubic meter ($\mu g/m^3$). The measurements for TSP, sulfate, and nitrate all came from a hi-volume air sampler. The methods are detailed in Appendix A of Health Consequences of Sulfur Oxides: A Report from CHESS, 1970-1971.[16] The $NO_2$ data were measured by the Jacobs-Hochheiser procedure. These data are presented only to give a rough estimate of the relative exposures during the years 1970 to 1972. The CHESS aerometric data are presented in Tables 10-13. Table 14 gives a summary by year. There were two sites in Red Bank, two in Brainerd, and five in the Harrison community. The locations of the sites are shown in Figure 1.

Although there is much site-to-site and year-to-year variation, some general conclusions about the areas can be drawn: 1) TSP levels have been quite similar across all areas; the levels in Harrison were slightly lower if there were any differences, 2) Sulfate fractions were very similar across all areas, 3) Nitrate levels have been highest in Harrison, and lowest in Red Bank, 4) $NO_2$ values were higher primarily at site 31 in Harrison, but sites nearer the Volunteer Army Ammunition Plant showing higher values than those farther away, and 5) both $NO_2$ and nitrate levels were higher around 1968-1969 in all areas, and have decreased since then.

## RESULTS

The adjusted mean FEV's for each community appear in Table 15. These FEV's are adjusted for height, age, machine, and presence of symptoms. They are computed for each age-sex category by season. Where possible, each student's winter and spring readings were averaged and the analyses of these averages also appear in Table 15.

The adjusted means (Table 15) show generally lower values in the Harrison area during the winter season, but higher values in the spring season. There are almost no differences in the adjusted means for the average of the two seasons. None of the differences were significant at the .05 level for the winter season (Table 16). All significant inter-community differences showed Harrison with higher mean values.

One by-product of the analysis is a table of the effect of a cold, cough, or sore throat has on children's FEV. These average effects, adjusted for age, height, machine, and community are shown in Table 17. In all but one analysis (females less than 108 months, spring season), the adjusted mean values for children with symptoms were less than those without symptoms. These differences were significant at the .05 level in only 2 of the 7 analyses, however. The differences averaged about 20 cubic centimeters.

Regression coefficients, mean heights and ages, and mean square errors are given in Tables 18, 19, and 20. These values are presented for comparison with other studies. The regression coefficients verify the finding that the FEV's of younger children are more dependent on age than the FEV's of the older children. The tables can also be used to generate confidence intervals about the adjustment equations. Younger children, who have smaller lung capacities, showed an expected smaller mean square error. The averages of the two seasons also showed a smaller mean square error than either of the separate seasons, which is consistent with the properties of the variance of an average.

## CONCLUSIONS

The hypothesis was not supported that previous or current elevated $NO_2$ or nitrate exposures have an irreversible measureable effect on children's ventilatory performance. The only adjusted mean FEV's for the Harrison community that were lower than the other communities occurred in the winter season, and none of these were statistically significant. The means in the Harrison community for the spring season were generally higher than the other two communities, and the averages for the two seasons were quite similar for all three communities. There is nothing in the aerometric data to suggest that the Harrison community had a unique higher exposure during the winter season only.

The lack of consistent differences attributable to pollution in this study does not contradict the earlier study of Shy, et al.[9] The Shy study found a slight effect attributable to $NO_2$ pollution, but was done during a period of greatly elevated exposures, as indicated by the aerometric data. The present study was conducted at least two years after these elevated exposures. The effects on lung function may be at least partially reversible. There is always the possibility that machine or technician biases masked an existing effect, or that differences do exist but are too small to detect.

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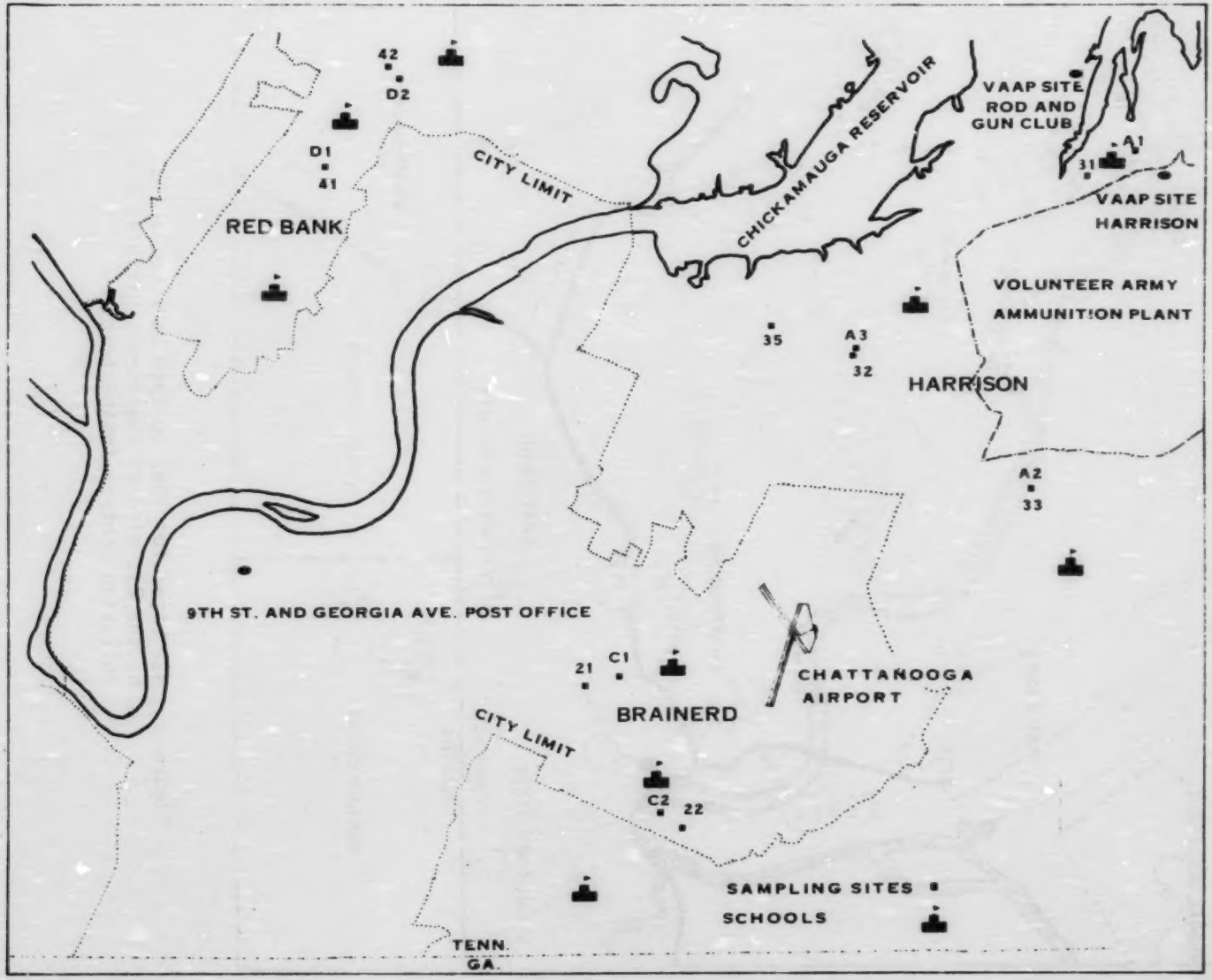


Figure 1. Air Monitoring Sites and School Locations in the Greater Chattanooga Area

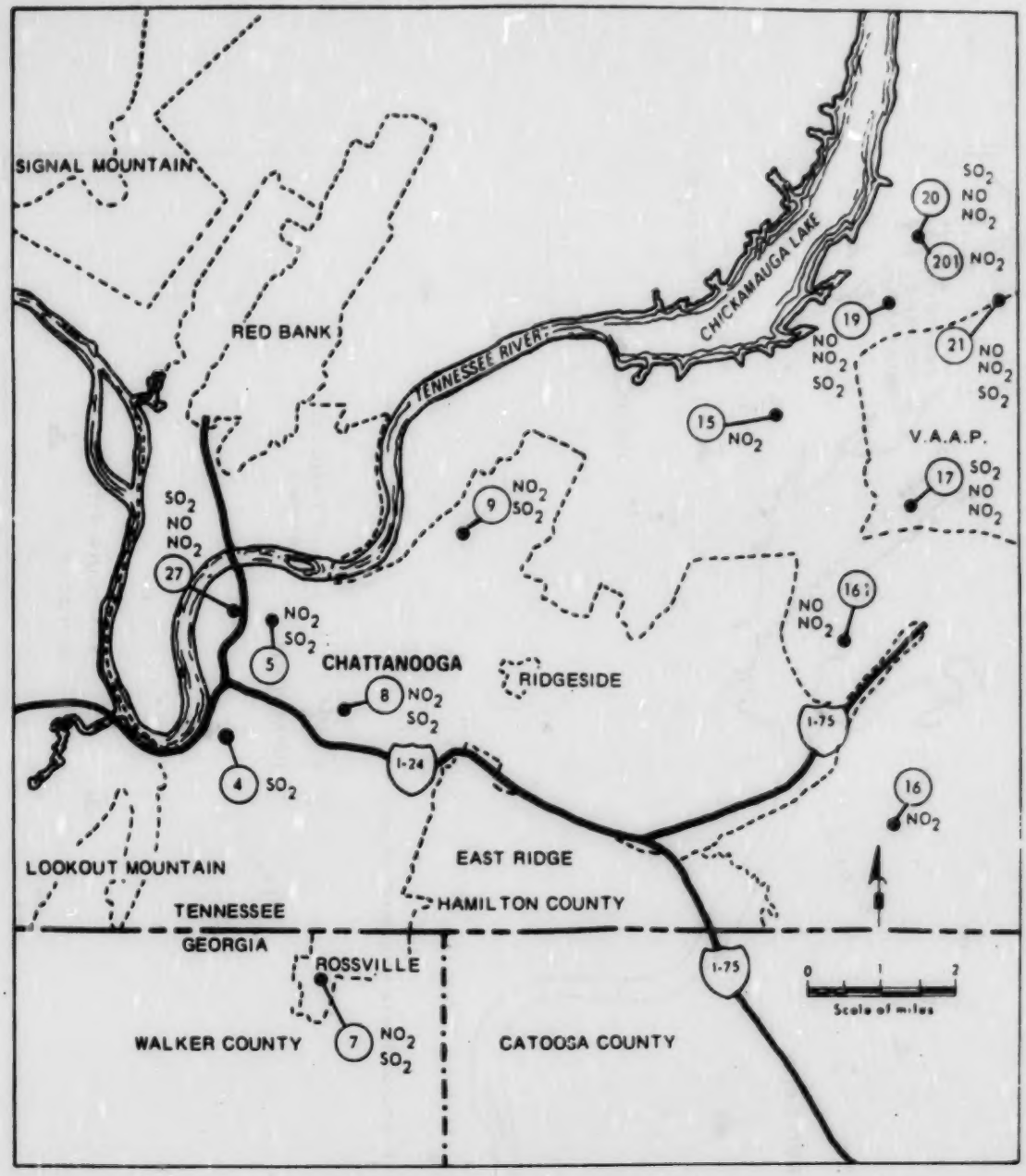


Figure 2. $NO_2$ Sites for 1967 to 1968 Data Collected by the Division of Abatement, National Air Pollution Control Administration

Table 1. Deletions and Subsets of the 1971-1972 Chattanooga Analysis File

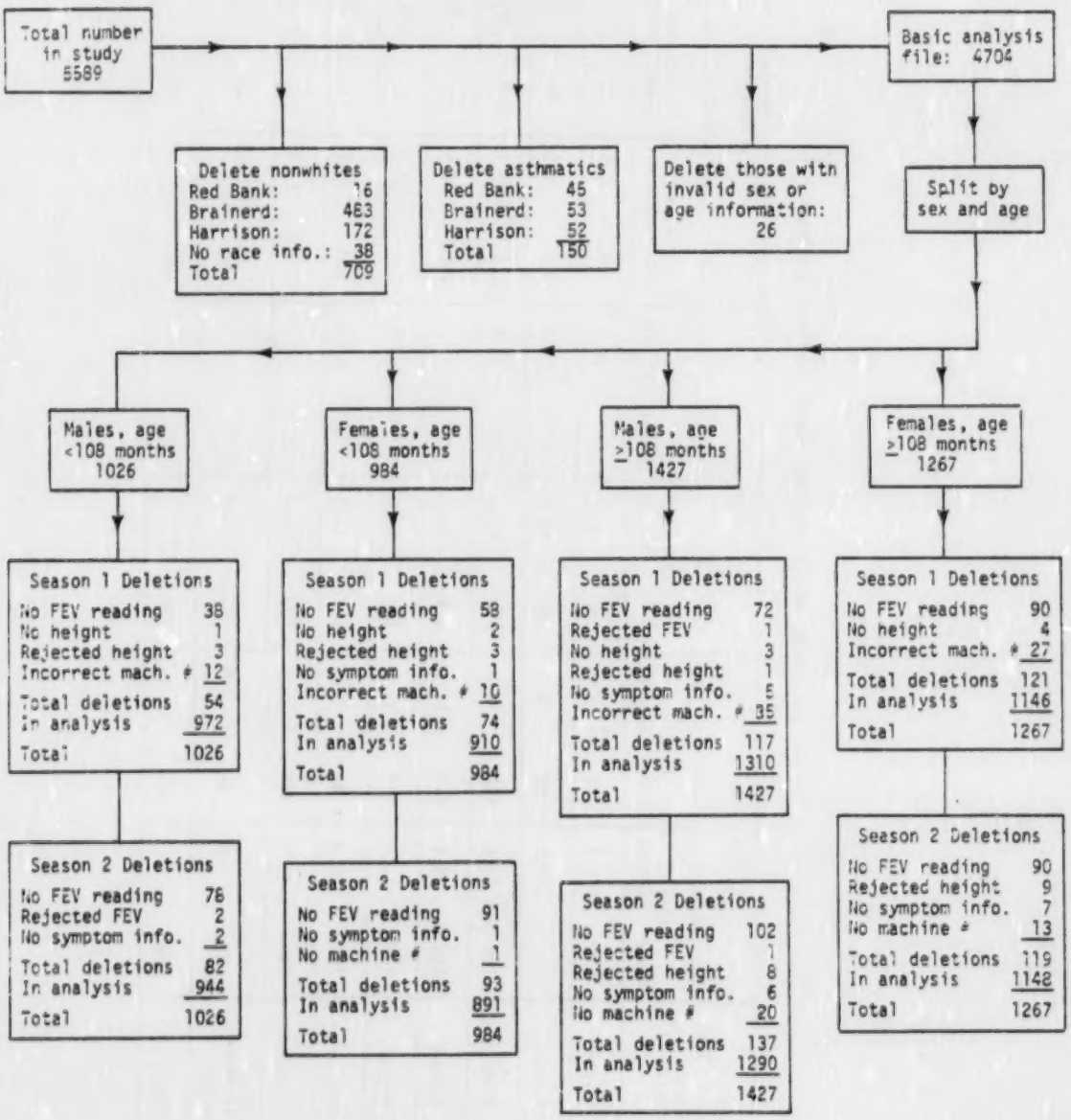

Table 2. Age and Sex Distribution of the Basic Analysis File

| Age at First Test Round (Season 1) | Red Bank | | | | Brainerd | | | | Harrison | | | | Total | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Males | | Females | | Males | | Females | | Males | | Females | | | |
| | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent | Number | Percent |
| 5 years | 6 | 0.7 | 10 | 1.2 | 0 | 0.0 | 0 | 0.0 | 10 | 1.2 | 9 | 1.2 | 35 | 0.7 |
| 6 years | 71 | 7.8 | 68 | 8.3 | 68 | 10.0 | 63 | 9.6 | 84 | 9.7 | 84 | 10.9 | 438 | 9.3 |
| 7 years | 125 | 13.8 | 138 | 16.8 | 107 | 15.8 | 104 | 15.8 | 154 | 17.7 | 138 | 17.9 | 766 | 16.3 |
| 8 years | 140 | 15.5 | 116 | 14.1 | 109 | 16.1 | 107 | 16.2 | 152 | 17.5 | 147 | 19.1 | 771 | 16.4 |
| 9 years | 172 | 19.0 | 158 | 19.2 | 102 | 15.0 | 113 | 17.1 | 177 | 20.4 | 148 | 19.2 | 870 | 18.5 |
| 10 years | 163 | 18.0 | 142 | 17.3 | 104 | 15.3 | 103 | 15.6 | 149 | 17.1 | 113 | 14.7 | 774 | 16.5 |
| 11 years | 140 | 15.5 | 125 | 15.2 | 138 | 20.4 | 133 | 20.2 | 101 | 11.6 | 85 | 11.0 | 722 | 15.3 |
| 12 years or more | 89 | 9.8 | 64 | 7.8 | 50 | 7.4 | 36 | 5.5 | 42 | 4.8 | 47 | 6.1 | 328 | 7.0 |
| Total | 906 | | 821 | | 678 | | 659 | | 869 | | 771 | | 4704 | |

Table 3. Education of Head of Household for Basic Analysis File

| | Red Bank | | Brainerd | | Harrison | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| No Information | 669 | 38.7[a] | 637 | 47.6[a] | 626 | 38.2[a] |
| With Information: | | | | | | |
| Less Than High School | 161 | 15.2 | 91 | 13.0 | 164 | 16.2 |
| High School | 306 | 28.9 | 212 | 30.3 | 295 | 29.1 |
| More Than High School | 324 | 30.6 | 238 | 34.0 | 333 | 32.8 |
| College Graduate | 267 | 25.2 | 159 | 22.7 | 222 | 21.9 |
| Total | 1058 | 61.3[a] | 700 | 52.4[a] | 1014 | 61.8[a] |

Chi-square for educational differences by community = 7.416, p = .2841.

[a] These percents are of both those with and without educational information. The other percents are just of those with educational information.

Table 4. Smoking Distribution of Parents for Basic Analysis File

Fathers

| | Red Bank | | Brainerd | | Harrison | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| No Information or No Father | 738 | 42.7[a] | 718 | 53.7[a] | 676 | 41.2[a] |
| With Information: | | | | | | |
| Never Smoked | 253 | 25.6 | 149 | 24.1 | 259 | 26.9 |
| Ex-smoker | 280 | 28.3 | 161 | 26.0 | 241 | 25.0 |
| Less Than 1 Pack/Day | 64 | 6.5 | 64 | 10.3 | 83 | 8.6 |
| About 1 Pack/Day | 216 | 21.8 | 161 | 26.0 | 223 | 23.1 |
| Greater Than 1 Pack/Day | 176 | 17.8 | 84 | 13.6 | 158 | 16.4 |
| Total | 989 | 57.3[a] | 619 | 46.3[a] | 964 | 58.8[a] |

Chi-square for smoking differences by community = 17.570, p = .0247.

Mothers

| | Red Bank | | Brainerd | | Harrison | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| No Information or No Mother | 673 | 39.0[a] | 640 | 47.9[a] | 632 | 38.6[a] |
| With Information: | | | | | | |
| Never Smoked | 574 | 54.5 | 354 | 50.8 | 540 | 53.6 |
| Ex-smoker | 153 | 14.5 | 88 | 12.6 | 132 | 13.1 |
| Less Than 1 Pack/Day | 105 | 10.0 | 96 | 13.8 | 109 | 10.8 |
| About 1 Pack/Day | 163 | 15.5 | 110 | 15.8 | 150 | 14.9 |
| Greater Than 1 Pack/Day | 59 | 5.6 | 49 | 7.0 | 77 | 7.6 |
| Total | 1054 | 61.0[a] | 697 | 52.1[a] | 1008 | 61.4[a] |

Chi-square for smoking differences by community = 11.685, p = .1658.

[a] These percents are of both those with and without smoking information. The other percents are just of those with smoking information.

Table 5. Parents Length of Residence in Present City for Basic Analysis File

| | Red Bank | | Brainerd | | Harrison | |
|---|---|---|---|---|---|---|
| | Number | Percent | Number | Percent | Number | Percent |
| No Information | 669 | 38.7[a] | 639 | 47.8[a] | 626 | 38.2[a] |
| With Information: | | | | | | |
| 0-1 Years | 85 | 8.0 | 35 | 5.0 | 100 | 9.9 |
| 2-3 Years | 122 | 11.5 | 61 | 8.7 | 109 | 10.7 |
| 4-7 Years | 144 | 13.6 | 105 | 15.0 | 171 | 16.9 |
| 8-11 Years | 153 | 14.5 | 70 | 10.0 | 123 | 12.1 |
| 12 or more Years | 554 | 52.4 | 427 | 61.2 | 511 | 50.4 |
| Total | 1058 | 61.3[a] | 698 | 52.2[a] | 1014 | 61.8[a] |

Chi-square for length of residence differences by community = 35.465, $p < .0001$.

[a] These percents are of both those with and without residence information. The other percents are just of those with residence information.

Table 6. Annual Means of Aerometric Data from the Downtown Post Office. All measurements are in $\mu g/m^3$. TSP means are geometric; nitrate and sulfate means are arithmetic.

| | 9th St. and Georgia Ave. Post Office | | |
|---|---|---|---|
| | TSP | Nitrate | Sulfate |
| 1972 | 106. | 2.27 | 12.7 |
| 1971 | - | - | - |
| 1970 | 113. | 3.04 | 10.0 |
| 1969 | 105. | 3.98 | 13.9 |
| 1968 | 135. | 4.12 | 9.4 |
| 1967 | 139. | 2.10 | 8.5 |
| 1966 | 131. | 2.04 | 9.6 |
| 1965 | 143. | 2.44 | 9.2 |
| 1964 | 179. | 2.65 | 9.4 |
| 1963 | 183. | - | - |
| 1962 | 146. | 1.13 | 7.0 |
| 1961 | 190. | 1.38 | 10.5 |
| 1960 | 171. | 1.64 | 8.9 |
| 1959 | 181. | 1.52 | 10.5 |
| 1958 | 215. | 2.20 | 13.3 |

Table 7. Quarterly and Annual $NO_2$ Means for Two Sites at the Volunteer Army Ammunition Plant. All measurements are in $\mu g/m^3$.

| | Harrison School (Gate 20) | | | | |
|---|---|---|---|---|---|
| | Jan-Mar | Apr-June | July-Sept | Oct-Dec | Annual |
| 1968 | 140. | 240. | 192. | 199. | 193. |
| 1969 | 135. | 240. | 275. | 125. | 194. |
| 1970 | 120. | 150. | 101. | 108. | 120. |
| 1971 | 98. | 103. | 64. | 78. | 86. |
| 1972 | 80. | 82. | 84. | 71. | 79. |

| | Chattanooga Red and Gun Club | | | | |
|---|---|---|---|---|---|
| | Jan-Mar | Apr-June | July-Sept | Oct-Dec | Annual |
| 1968 | 174. | 382. | 273. | 314. | 286. |
| 1969 | 125. | 361. | 370. | 165. | 255. |
| 1970 | 236. | 218. | 170. | 157. | 195. |
| 1971 | 122. | 186. | 122. | 133. | 140. |
| 1972 | 102. | 113. | 155. | 114. | 121. |

Table 8. Division of Abatement, National Air Pollution Control Administration, $NO_2$ Means for September 1967 to November 1968. All values are arithmetic means given in $\mu g/m^3$

| Station Number | Operating Period | Number Observations | Arithmetic Mean |
|---|---|---|---|
| 5 | 12/67 - 3/68 | 95 | 78. |
| 7 | 4/68 - 11/68 | 233 | 78. |
| 15 | 12/67 - 11/68 | 341 | 157. |
| 16 | 12/67 - 3/68 | 96 | 59. |
| 17 | 2/68 - 11/68 | 295 | 196. |
| 19 | 5/68 - 11/68 | 202 | 412. |
| 20 | 9/67 - 11/68 | 456 | 294. |
| 21 | 9/67 - 11/68 | 457 | 176. |
| 27 | 4/68 - 11/68 | 201 | 78. |
| 161 | 4/68 - 11/68 | 230 | 157. |
| 201 | 12/67 - 5/68 | 128 | 314. |

Table 9. Division of Health Effects, National Air Pollution Control Administration, Pollution Means for October 1968 to April 1969. All values are given in $\mu g/m^3$. TSP means are geometric means; all others are arithmetic means.

| Site | Pollutant | | | |
|---|---|---|---|---|
| | $NO_2$ | Nitrate | Sulfate | TSP |
| Red Bank D1 | 84.9 | 1.7 | 10.1 | 56.7 |
| Red Bank D2 | 85.8 | 1.8 | 9.9 | 51.4 |
| Brainerd C1 | 111.1 | 2.6 | 10.1 | 55.7 |
| Brainerd C2 | 137.1 | 2.8 | 9.6 | 66.8 |
| Harrison A1 | 216.5 | 7.3 | 13.2 | 74.3 |
| Harrison A2 | 122.2 | 3.9 | 10.0 | 52.2 |
| Harrison A3 | 153.8 | 6.3 | 11.4 | 70.5 |

TABLE 10. CHATTANOOGA TSP FREQUENCY DISTRIBUTIONS BY SITE.
VALUES GIVEN IN MICROGRAMS PER CUBIC METER.

| | MONTHS | NO. OBS. | FREQUENCY DISTRIBUTION - PERCENT MIN | 10 | 30 | 50 | 70 | 90 | 95 | 99 | MAX | ARITH. MEAN | GEO. MEAN | STD. DEV. | S.D. LOGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RED BANK | 7/71- 9/71 | 92 | 37.4 | 45.2 | 57.8 | 64.0 | 73.1 | 90.2 | 94.2 | 104.5 | 126.1 | 66.0 | 64.0 | 16.7 | .25 |
| SITE 41 | 10/71-12/71 | 87 | 27.9 | 35.9 | 56.0 | 69.2 | 84.2 | 110.0 | 127.6 | 137.5 | 145.4 | 72.5 | 66.8 | 28.7 | .42 |
| | 1/72- 3/72 | 81 | 16.0 | 35.4 | 62.5 | 84.4 | 111.9 | 150.4 | 168.0 | 214.9 | 217.4 | 90.9 | 78.8 | 46.0 | .57 |
| | 4/72- 6/72 | 85 | 26.1 | 41.8 | 59.5 | 75.7 | 92.1 | 115.6 | 136.9 | 180.4 | 232.3 | 78.7 | 72.4 | 34.3 | .41 |
| | 7/71- 6/72 | 345 | 16.0 | 39.1 | 58.4 | 69.7 | 87.4 | 118.3 | 137.4 | 200.6 | 232.3 | 76.6 | 70.0 | 33.8 | .43 |
| RED BANK | 7/71- 9/71 | 92 | 24.0 | 38.8 | 52.2 | 59.7 | 69.5 | 85.7 | 88.1 | 95.1 | 121.1 | 61.1 | 58.5 | 17.5 | .31 |
| SITE 42 | 10/71-12/71 | 86 | 16.7 | 29.9 | 47.0 | 61.6 | 79.0 | 105.2 | 118.4 | 139.8 | 144.1 | 65.1 | 58.5 | 29.5 | .48 |
| | 1/72- 3/72 | 78 | 25.5 | 36.6 | 59.2 | 84.2 | 110.0 | 151.6 | 171.8 | 297.3 | 612.2 | 94.8 | 79.8 | 72.[illegible] | .57 |
| | 4/72- 6/72 | 89 | 23.7 | 45.3 | 61.8 | 80.6 | 98.2 | 134.7 | 149.4 | 211.6 | 261.3 | 86.0 | 78.3 | 39.0 | .44 |
| | 7/71- 6/72 | 345 | 16.7 | 36.8 | 54.4 | 67.0 | 86.7 | 120.6 | 146.4 | 193.8 | 612.2 | 76.1 | 67.6 | 45.5 | .47 |
| BRAINERD | 7/71- 9/71 | 92 | 24.2 | 41.7 | 55.4 | 63.6 | 77.5 | 90.5 | 95.3 | 105.1 | 107.5 | 65.9 | 63.0 | 18.8 | .31 |
| SITE 21 | 10/71-12/71 | 87 | 18.1 | 37.6 | 59.1 | 73.4 | 88.8 | 122.4 | 144.5 | 203.3 | 210.1 | 79.2 | 71.2 | 36.9 | .47 |
| | 1/72- 3/72 | 83 | 17.3 | 33.4 | 49.4 | 63.0 | 84.2 | 141.[illegible] | 166.8 | 235.0 | 265.9 | 77.5 | 66.2 | 48.6 | .56 |
| | 4/72- 6/72 | 88 | 23.7 | 41.3 | 60.2 | 76.6 | 89.7 | 116.5 | 123.7 | 138.7 | 156.1 | 77.5 | 72.0 | 28.2 | .41 |
| | 7/71- 6/72 | 350 | 17.3 | 38.1 | 56.4 | 68.4 | 84.7 | 114.5 | 136.3 | 208.1 | 265.9 | 74.9 | 68.0 | 34.8 | .44 |
| BRAINERD | 7/71- 9/71 | 91 | 23.1 | 36.2 | 48.0 | 56.7 | 67.2 | 80.5 | 84.8 | 95.2 | 112.1 | 57.5 | 55.0 | 16.9 | .31 |
| SITE 22 | 10/71-12/71 | 85 | 21.2 | 32.3 | 44.1 | 55.9 | 76.4 | 98.2 | 109.9 | 141.2 | 195.0 | 62.7 | 57.1 | 28.6 | .43 |
| | 1/72- 3/72 | 75 | 21.3 | 31.9 | 50.5 | 57.6 | 84.4 | 135.0 | 158.2 | 226.7 | 234.0 | 72.5 | 62.6 | 43.3 | .54 |
| | 4/72- 6/72 | 88 | 22.3 | 40.9 | 56.9 | 62.9 | 77.4 | 101.5 | 115.7 | 158.4 | 231.5 | 70.0 | 65.0 | 29.7 | .38 |
| | 7/71- 6/72 | 339 | 21.2 | 35.1 | 49.6 | 58.8 | 72.7 | 99.0 | 115.8 | 182.9 | 234.0 | 65.4 | 59.6 | 30.8 | .42 |
| HARRISON | 7/71- 9/71 | 83 | 17.3 | 33.8 | 45.3 | 58.3 | 72.5 | 96.8 | 113.7 | 155.3 | 183.4 | 63.4 | 57.9 | 28.6 | .43 |
| SITE 31 | 10/71-12/71 | 84 | 17.8 | 25.9 | 39.8 | 52.7 | 71.5 | 112.4 | 131.6 | 158.2 | 164.2 | 60.8 | 52.4 | 34.6 | .55 |
| | 1/72- 3/72 | 76 | 14.7 | 22.8 | 36.1 | 44.7 | 57.6 | 94.2 | 111.9 | 153.7 | 179.8 | 53.2 | 46.0 | 31.1 | .54 |
| | 4/72- 6/72 | 78 | 17.0 | 33.9 | 51.2 | 62.9 | 76.5 | 117.0 | 128.5 | 139.6 | 148.6 | 68.4 | 61.9 | 30.0 | .47 |
| | 7/71- 6/72 | 321 | 14.7 | 28.0 | 42.1 | 55.7 | 71.5 | 105.0 | 124.6 | 156.2 | 183.4 | 61.5 | 54.3 | 31.5 | .51 |
| HARRISON | 7/71- 9/71 | 92 | 22.7 | 38.2 | 47.7 | 55.4 | 72.5 | 87.5 | 97.3 | 111.5 | 130.5 | 60.8 | 57.2 | 21.3 | .36 |
| SITE 32 | 10/71-12/71 | 80 | 19.4 | 27.9 | 39.8 | 53.4 | 77.0 | 105.0 | 115.7 | 129.1 | 133.8 | 61.3 | 54.6 | 29.5 | .49 |
| | 1/72- 3/72 | 84 | 11.5 | 21.2 | 34.2 | 44.4 | 63.1 | 86.4 | 106.5 | 115.1 | 118.8 | 50.8 | 44.6 | 25.8 | .52 |
| | 4/72- 6/72 | 83 | 18.8 | 37.7 | 52.4 | 63.0 | 83.2 | 106.3 | 115.7 | 122.9 | 130.8 | 68.2 | 63.2 | 25.7 | .40 |
| | 7/71- 6/72 | 339 | 11.5 | 29.2 | 43.4 | 55.3 | 72.3 | 98.8 | 110.1 | 125.3 | 133.8 | 60.2 | 54.5 | 26.2 | .46 |
| HARRISON | 7/71- 9/71 | 91 | 18.2 | 34.1 | 44.3 | 53.6 | 61.4 | 78.1 | 87.4 | 128.3 | 162.7 | 56.4 | 52.7 | 22.0 | .36 |
| SITE 33 | 10/71-12/71 | 84 | 17.4 | 27.6 | 36.4 | 47.1 | 68.3 | 92.7 | 102.2 | 114.9 | 124.5 | 54.4 | 48.9 | 25.4 | .47 |
| | 1/72- 3/72 | 78 | 11.7 | 23.7 | 34.9 | 45.8 | 54.9 | 75.4 | 83.9 | 136.2 | 155.0 | 48.7 | 43.5 | 24.6 | .49 |
| | 4/72- 6/72 | 84 | 16.6 | 38.1 | 53.2 | 62.7 | 72.1 | 91.1 | 100.1 | 106.1 | 107.0 | 63.6 | 60.1 | 20.1 | .36 |
| | 7/71- 6/72 | 337 | 11.7 | 29.7 | 41.6 | 53.1 | 65.2 | 85.7 | 99.6 | 124.5 | 162.7 | 55.9 | 51.1 | 23.6 | .43 |
| HARRISON | 7/71- 9/71 | 92 | 17.1 | 26.4 | 38.0 | 48.9 | 61.8 | 83.2 | 86.1 | 123.9 | 128.7 | 52.3 | 47.8 | 22.2 | .43 |
| SITE 34 | 10/71-12/71 | 85 | 12.9 | 17.4 | 27.7 | 39.6 | 55.1 | 75.6 | 94.7 | 109.1 | 119.2 | 43.9 | 38.1 | 24.0 | .54 |
| | 1/72- 3/72 | 70 | 11.1 | 18.5 | 30.9 | 36.3 | 45.1 | 66.5 | 88.6 | 102.9 | 109.6 | 41.0 | 36.5 | 20.7 | .49 |
| | 4/72- 6/72 | 85 | 15.6 | 31.3 | 43.2 | 58.7 | 69.0 | 97.3 | 111.9 | 149.9 | 210.3 | 61.3 | 54.6 | 30.8 | .49 |
| | 7/71- 6/72 | 332 | 11.1 | 22.2 | 34.8 | 44.5 | 60.4 | 83.9 | 98.7 | 123.0 | 210.3 | 50.1 | 44.1 | 25.9 | .51 |
| HARRISON | 7/71- 9/71 | 92 | 22.7 | 37.7 | 46.5 | 53.1 | 68.9 | 89.0 | 94.2 | 114.6 | 119.0 | 5[illegible].5 | 56.1 | 20.6 | .34 |
| SITE 35 | 10/71-12/71 | 84 | 16.1 | 27.9 | 57.1 | 70.6 | 83.9 | 115.5 | 139.9 | 181.8 | 207.2 | 73.5 | 64.7 | 36.4 | .53 |
| | 1/72- 3/72 | 83 | 15.0 | 29.2 | 38.6 | 49.9 | 65.5 | 102.8 | 126.2 | 140.8 | 143.6 | 58.6 | 51.6 | 30.9 | .50 |
| | 4/72- 6/72 | 84 | 16.2 | 37.0 | 46.4 | 59.0 | 74.8 | 118.2 | 140.0 | 165.8 | 180.1 | 68.1 | 60.6 | 34.7 | .48 |
| | 7/71- 6/72 | 343 | 15.0 | 32.5 | 44.6 | 59.4 | 74.7 | 105.2 | 129.1 | 164.9 | 207.2 | 64.8 | 58.0 | 31.5 | .47 |

TABLE 11. CHATTANOOGA SULFATE FRACTION FREQUENCY DISTRIBUTIONS BY SITE.
VALUES GIVEN IN MICROGRAMS PER CUBIC METER.

| | MONTHS | NO. OBS. | MIN | FREQUENCY DISTRIBUTION - PERCENT 10 | 30 | 50 | 70 | 90 | 95 | 99 | MAX | ARITH. MEAN | GEO. MEAN | STD. DEV. | S.D. LOGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RED BANK | 7/71- 9/71 | 92 | 2.5 | 5.6 | 7.7 | 10.4 | 13.3 | 17.3 | 21.6 | 25.4 | 28.2 | 11.2 | 10.1 | 5.1 | .47 |
| SITE 41 | 10/71-12/71 | 86 | 2.3 | 5.3 | 7.2 | 9.5 | 12.4 | 18.1 | 23.8 | 34.4 | 40.8 | 11.2 | 9.7 | 6.6 | .51 |
| | 1/72- 3/72 | 82 | 2.2 | 5.3 | 7.1 | 8.2 | 10.7 | 13.5 | 17.9 | 33.3 | 41.2 | 9.7 | 8.8 | 5.5 | .44 |
| | 4/72- 6/72 | 85 | 1.1 | 5.5 | 7.4 | 8.5 | 11.1 | 17.7 | 21.7 | 28.0 | 34.6 | 10.3 | 9.1 | 5.6 | .51 |
| | 7/71- 6/72 | 345 | 1.1 | 5.5 | 7.4 | 9.1 | 11.9 | 17.2 | 22.2 | 32.5 | 41.2 | 10.6 | 9.4 | 5.7 | .48 |
| RED BANK | 7/71- 9/71 | 92 | .8 | 5.3 | 7.5 | 9.8 | 13.4 | 17.2 | 20.0 | 24.1 | 27.5 | 10.9 | 9.7 | 5.1 | .52 |
| SITE 42 | 10/71-12/71 | 86 | 4.5 | 5.4 | 7.0 | 8.5 | 10.8 | 14.4 | 19.0 | 21.9 | 22.0 | 9.6 | 8.8 | 4.1 | .39 |
| | 1/72- 3/72 | 80 | 3.7 | 5.3 | 7.4 | 8.3 | 10.7 | 15.0 | 17.9 | 26.2 | 28.4 | 9.8 | 8.9 | 4.7 | .42 |
| | 4/72- 6/72 | 89 | 3.4 | 5.8 | 7.6 | 9.2 | 12.1 | 18.1 | 20.0 | 25.2 | 29.6 | 10.8 | 9.8 | 5.1 | .44 |
| | 7/71- 6/72 | 347 | .8 | 5.4 | 7.4 | 8.9 | 11.8 | 17.0 | 19.7 | 25.1 | 29.6 | 10.3 | 9.3 | 4.8 | .45 |
| BRAINERD | 7/71- 9/71 | 92 | 3.3 | 5.5 | 7.3 | 10.7 | 13.8 | 18.2 | 21.8 | 28.5 | 30.4 | 11.5 | 10.3 | 5.5 | .49 |
| SITE 21 | 10/71-12/71 | 87 | 4.2 | 5.8 | 7.1 | 9.0 | 11.2 | 17.1 | 19.3 | 21.4 | 23.7 | 10.1 | 9.3 | 4.3 | .40 |
| | 1/72- 3/72 | 84 | 3.7 | 5.4 | 7.8 | 8.9 | 11.1 | 14.9 | 18.1 | 21.8 | 23.1 | 9.9 | 9.2 | 4.0 | .38 |
| | 4/72- 6/72 | 89 | 2.1 | 5.9 | 7.6 | 9.3 | 11.5 | 17.6 | 19.1 | 35.6 | 50.1 | 10.9 | 9.6 | 6.6 | .48 |
| | 7/71- 6/72 | 352 | 2.1 | 5.6 | 7.4 | 9.4 | 12.0 | 17.5 | 19.4 | 27.9 | 50.1 | 10.6 | 9.6 | 5.2 | .44 |
| BRAINERD | 7/71- 9/71 | 91 | 2.2 | 5.6 | 7.8 | 9.8 | 13.1 | 16.8 | 19.8 | 22.9 | 32.0 | 11.0 | 9.9 | 5.0 | .47 |
| SITE 22 | 10/71-12/71 | 86 | 3.4 | 4.8 | 6.5 | 7.7 | 10.4 | 16.2 | 18.1 | 21.6 | 21.9 | 9.2 | 8.3 | 4.4 | .45 |
| | 1/72- 3/72 | 78 | 4.4 | 6.0 | 7.6 | 8.6 | 10.5 | 14.6 | 18.7 | 45.7 | 52.4 | 10.3 | 9.2 | 7.1 | .43 |
| | 4/72- 6/72 | 87 | 4.0 | 5.8 | 7.6 | 9.3 | 11.3 | 16.5 | 17.6 | 28.4 | 56.5 | 10.7 | 9.6 | 6.5 | .44 |
| | 7/71- 6/72 | 342 | 2.2 | 5.4 | 7.2 | 8.8 | 11.3 | 16.4 | 18.8 | 28.6 | 56.5 | 10.3 | 9.2 | 5.8 | .45 |
| HARRISON | 7/71- 9/71 | 83 | 3.9 | 6.0 | 7.4 | 11.4 | 14.1 | 18.5 | 22.0 | 30.6 | 40.6 | 12.0 | 10.7 | 6.1 | .48 |
| SITE 31 | 10/71-12/71 | 83 | 1.2 | 5.0 | 6.2 | 8.1 | 10.5 | 16.1 | 18.1 | 21.8 | 22.2 | 9.3 | 8.3 | 4.5 | .50 |
| | 1/72- 3/72 | 78 | 3.1 | 4.6 | 6.1 | 7.3 | 9.4 | 14.4 | 16.9 | 30.5 | 36.9 | 10.7 | 7.7 | 5.2 | .46 |
| | 4/72- 6/72 | 78 | 2.9 | 6.3 | 7.6 | 9.3 | 11.4 | 15.6 | 19.0 | 36.9 | 54.3 | 10.8 | 9.6 | 6.7 | .45 |
| | 7/71- 6/72 | 322 | 1.2 | 5.3 | 6.9 | 8.7 | 11.6 | 17.2 | 19.0 | 31.1 | 54.3 | 10.2 | 9.0 | 5.8 | .49 |
| HARRISON | 7/71- 9/71 | 92 | 1.5 | 6.1 | 8.1 | 11.2 | 14.8 | 19.5 | 22.2 | 26.8 | 40.8 | 12.2 | 10.8 | 6.0 | .51 |
| SITE 32 | 10/71-12/71 | 80 | 1.1 | 5.1 | 6.1 | 8.3 | 11.2 | 14.5 | 18.4 | 22.5 | 25.7 | 9.2 | 8.3 | 4.4 | .48 |
| | 1/72- 3/72 | 84 | 3.1 | 4.7 | 6.2 | 7.6 | 9.3 | 12.2 | 13.6 | 18.9 | 19.9 | 8.1 | 7.6 | 3.3 | .38 |
| | 4/72- 6/72 | 84 | .9 | 6.2 | 7.8 | 9.2 | 11.1 | 16.2 | 18.3 | 20.7 | 26.7 | 10.1 | 9.3 | 4.3 | .46 |
| | 7/71- 6/72 | 340 | .9 | 5.2 | 6.9 | 8.7 | 11.5 | 16.4 | 19.2 | 24.6 | 40.8 | 10.0 | 8.9 | 4.9 | .48 |
| HARRISON | 7/71- 9.71 | 91 | 2.0 | 5.8 | 8.1 | 11.6 | 14.9 | 18.9 | 21.0 | 27.2 | 43.8 | 12.1 | 10.8 | 6.1 | .49 |
| SITE 33 | 10/71-12/71 | 82 | .6 | 5.2 | 6.8 | 8.2 | 11.2 | 16.4 | 19.2 | 22.5 | 24.3 | 9.8 | 8.7 | 4.7 | .52 |
| | 1/72- 3/72 | 81 | 4.6 | 5.7 | 7.4 | 8.7 | 10.7 | 13.2 | 14.0 | 21.5 | 25.8 | 9.4 | 8.8 | 3.5 | .34 |
| | 4/72- 6/72 | 85 | 4.0 | 6.2 | 8.3 | 10.4 | 12.0 | 16.7 | 19.4 | 25.0 | 31.3 | 10.9 | 10.0 | 4.7 | .40 |
| | 7/71- 6/72 | 339 | .6 | 5.7 | 7.6 | 9.3 | 12.3 | 16.8 | 19.5 | 24.9 | 43.8 | 10.6 | 9.6 | 5.0 | .45 |
| HARRISON | 7/71- 9/71 | 92 | 2.7 | 5.6 | 7.6 | 10.1 | 14.2 | 18.6 | 20.4 | 24.6 | 25.1 | 11.2 | 10.0 | 5.2 | .49 |
| SITE 34 | 10/71-12/71 | 82 | 1.7 | 4.7 | 7.1 | 9.3 | 11.7 | 17.8 | 19.5 | 22.5 | 23.5 | 10.2 | 9.0 | 5.0 | .52 |
| | 1/72- 3/72 | 76 | 3.4 | 5.6 | 7.0 | 8.1 | 9.7 | 13.7 | 16.6 | 27.6 | 38.9 | 9.3 | 8.5 | 5.0 | .40 |
| | 4/72- 6/72 | 85 | 2.7 | 5.6 | 8.0 | 9.6 | 11.9 | 15.7 | 18.0 | 29.9 | 46.4 | 10.8 | 9.8 | 5.7 | .43 |
| | 7/71- 6/72 | 335 | 1.7 | 5.3 | 7.4 | 9.4 | 11.7 | 16.7 | 19.6 | 25.9 | 46.4 | 10.4 | 9.3 | 5.3 | .47 |
| HARRISON | 7/71- 9/71 | 91 | 3.6 | 6.0 | 8.2 | 11.2 | 13.8 | 19.0 | 21.2 | 26.2 | 30.5 | 11.9 | 10.8 | 5.3 | .44 |
| SITE 35 | 10/71-12/71 | 82 | .7 | 5.4 | 6.9 | 9.3 | 12.6 | 17.2 | 20.7 | 24.7 | 27.1 | 10.4 | 9.1 | 5.2 | .56 |
| | 1/72- 3/72 | 85 | 3.2 | 4.8 | 6.3 | 7.9 | 9.7 | 13.7 | 18.2 | 30.1 | 36.6 | 9.1 | 8.1 | 5.2 | .46 |
| | 4/72- 6/72 | 84 | 2.5 | 5.5 | 7.5 | 8.9 | 11.3 | 14.7 | 17.4 | 26.0 | 30.3 | 10.0 | 9.1 | 4.6 | .42 |
| | 7/71- 6/72 | 342 | .7 | 5.4 | 7.3 | 9.1 | 11.7 | 17.2 | 20.6 | 28.1 | 36.6 | 10.4 | 9.3 | 5.2 | .48 |

TABLE 12. CHATTANOOGA NITRATE FRACTION FREQUENCY DISTRIBUTIONS BY SITE.
VALUES GIVEN IN MICROGRAMS PER CUBIC METER.

| | MONTHS | NO. OBS. | MIN | FREQUENCY DISTRIBUTION - PERCENT 10 | 30 | 50 | 70 | 90 | 95 | 99 | MAX | ARITH. MEAN | GEO. MEAN | STD. DEV. | S.D. LOGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RED BANK | 7/71- 9/71 | 91 | BMDL | .5 | 1.4 | 1.7 | 2.4 | 3.1 | 3.6 | 4.5 | 4.6 | 1.9 | 1.4 | 1.0 | .96 |
| SITE 41 | 10/71-12/71 | 85 | .6 | 1.1 | 1.6 | 2.2 | 3.0 | 5.7 | 6.4 | 7.3 | 8.5 | 2.8 | 2.3 | 1.8 | .62 |
| | 1/72- 3/72 | 82 | .1 | .7 | 1.2 | 1.6 | 2.0 | 3.2 | 5.2 | 6.5 | 7.2 | 1.9 | 1.5 | 1.3 | .74 |
| | 4/72- 6/72 | 85 | .2 | .4 | .7 | .9 | 1.3 | 2.1 | 2.7 | 4.0 | 4.0 | 1.1 | .9 | .8 | .66 |
| | 7/71- 6/72 | 343 | BMDL | .5 | 1.1 | 1.6 | 2.2 | 3.7 | 4.8 | 6.9 | 8.5 | 1.9 | 1.5 | 1.4 | .82 |
| RED BANK | 7/71- 9/71 | 90 | BMDL | .4 | 1.2 | 1.6 | 1.9 | 2.8 | 3.5 | 4.5 | 4.5 | 1.6 | 1.2 | 1.0 | 1.08 |
| SITE 42 | 10/71-12/71 | 86 | .5 | 1.0 | 1.5 | 2.0 | 2.6 | 4.4 | 5.8 | 6.3 | 7.0 | 2.4 | 2.0 | 1.5 | .58 |
| | 1/72- 3/72 | 80 | .1 | .8 | 1.2 | 1.6 | 2.1 | 3.0 | 4.9 | 6.8 | 7.6 | 1.9 | 1.5 | 1.4 | .76 |
| | 4/72- 6/72 | 89 | .1 | .4 | .6 | .9 | 1.5 | 2.0 | 2.7 | 4.1 | 4.2 | 1.2 | .9 | .8 | .72 |
| | 7/71- 6/72 | 345 | BMDL | .5 | 1.1 | 1.6 | 2.0 | 3.3 | 4.3 | 6.1 | 7.6 | 1.8 | 1.3 | 1.3 | .86 |
| BRAINERD | 7/71- 9/71 | 91 | BMDL | .8 | 1.6 | 2.4 | 3.0 | 4.3 | 4.7 | 9.2 | 10.9 | 2.5 | 2.0 | 1.7 | .84 |
| SITE 21 | 10/71-12/71 | 87 | .4 | 1.4 | 2.3 | 2.8 | 4.1 | 6.7 | 7.9 | 14.1 | 27.2 | 3.9 | 3.1 | 3.4 | .67 |
| | 1/72- 3/72 | 84 | .3 | .9 | 1.6 | 2.1 | 3.2 | 6.7 | 8.5 | 11.8 | 14.3 | 3.0 | 2.3 | 2.5 | .73 |
| | 4/72- 6/72 | 89 | .3 | .5 | .8 | 1.2 | 1.7 | 3.1 | 3.5 | 4.4 | 5.5 | 1.5 | 1.2 | 1.0 | .67 |
| | 7/71- 6/72 | 351 | BMDL | .7 | 1.4 | 2.2 | 3.0 | 5.0 | 6.9 | 11.1 | 27.2 | 2.7 | 2.0 | 2.5 | .80 |
| BRAINERD | 7/71- 9/71 | 90 | BMDL | .8 | 1.3 | 2.0 | 2.9 | 4.2 | 4.8 | 8.4 | 10.1 | 2.4 | 1.8 | 1.7 | .91 |
| SITE 22 | 10/71-12/71 | 86 | .4 | 1.5 | 2.2 | 3.0 | 4.5 | 9.2 | 11.3 | 13.9 | 17.1 | 4.2 | 3.3 | 3.3 | .71 |
| | 1/72- 3/72 | 78 | .3 | 1.0 | 1.5 | 2.1 | 3.7 | 6.3 | 9.2 | 15.2 | 22.0 | 3.2 | 2.3 | 3.3 | .80 |
| | 4/72- 6/72 | 88 | .2 | .5 | .6 | 1.0 | 1.4 | 2.5 | 3.3 | 4.7 | 5.2 | 1.3 | 1.0 | 1.0 | .69 |
| | 7/71- 6/72 | 342 | BMDL | .6 | 1.2 | 2.0 | 3.0 | 5.2 | 8.2 | 13.3 | 22.0 | 2.8 | 1.9 | 2.7 | .89 |
| HARRISON | 7/71- 9/71 | 81 | BMDL | 1.4 | 2.7 | 4.5 | 7.9 | 16.6 | 21.7 | 29.6 | 38.1 | 7.3 | 4.3 | 7.2 | 1.25 |
| SITE 31 | 10/71-12/71 | 82 | .8 | 2.4 | 4.6 | 7.4 | 14.5 | 22.2 | 28.7 | 61.6 | 81.6 | 11.9 | 7.9 | 12.3 | .92 |
| | 1/72- 3/72 | 78 | .2 | 1.6 | 3.4 | 6.9 | 9.6 | 17.8 | 21.6 | 45.3 | 53.9 | 8.8 | 5.6 | 8.9 | 1.06 |
| | 4/72- 6/72 | 78 | .2 | .5 | 1.3 | 4.5 | 8.4 | 12.9 | 17.8 | 20.6 | 21.2 | 5.8 | 3.1 | 5.5 | 1.28 |
| | 7/71- 6/72 | 319 | BMDL | 1.0 | 2.9 | 5.9 | 9.8 | 18.2 | 22.3 | 41.9 | 81.6 | 8.5 | 4.9 | 9.1 | 1.18 |
| HARRISON | 7/71- 9/71 | 91 | BMDL | 1.1 | 1.9 | 2.8 | 4.3 | 7.0 | 8.6 | 12.3 | 13.5 | 3.5 | 2.6 | 2.7 | .95 |
| SITE 32 | 10/71-12/71 | 79 | .4 | 1.7 | 2.6 | 3.5 | 4.6 | 8.0 | 10.4 | 17.0 | 30.2 | 4.6 | 3.6 | 3.9 | .68 |
| | 1/72- 3/72 | 84 | .3 | .8 | 1.6 | 2.5 | 3.7 | 6.7 | 9.5 | 16.4 | 16.5 | 3.4 | 2.5 | 3.2 | .82 |
| | 4/72- 6/72 | 84 | .2 | .5 | 1.0 | 1.6 | 2.5 | 5.9 | 7.2 | 12.2 | 13.6 | 2.5 | 1.7 | 2.5 | .90 |
| | 7/71- 6/72 | 338 | BMDL | .7 | 1.6 | 2.6 | 3.9 | 7.0 | 9.0 | 14.0 | 30.2 | 3.5 | 2.5 | 3.2 | .89 |
| HARRISON | 7/71- 9/71 | 90 | BMDL | .7 | 1.6 | 2.7 | 3.5 | 5.4 | 6.5 | 9.3 | 10.1 | 2.9 | 2.1 | 2.0 | 1.01 |
| SITE 33 | 10/71-12/71 | 84 | .9 | 2.0 | 3.0 | 4.2 | 5.8 | 12.0 | 14.0 | 18.4 | 18.8 | 5.7 | 4.5 | 4.2 | .67 |
| | 1/72- 3/72 | 81 | .1 | 1.0 | 2.0 | 3.5 | 4.9 | 9.6 | 11.3 | 15.8 | 16.8 | 4.5 | 3.0 | 3.6 | 1.08 |
| | 4/72- 6/72 | 85 | .2 | .5 | 1.1 | 1.6 | 3.2 | 5.3 | 6.6 | 9.2 | 11.7 | 2.5 | 1.7 | 2.1 | .90 |
| | 7/71- 6/72 | 340 | BMDL | .8 | 1.8 | 3.2 | 4.3 | 8.5 | 11.3 | 16.3 | 18.8 | 3.9 | 2.6 | 3.4 | .99 |
| HARRISON | 7/71- 9/71 | 90 | BMDL | .9 | 1.8 | 2.3 | 4.1 | 8.3 | 10.4 | 13.5 | 16.3 | 3.7 | 2.4 | 3.3 | 1.02 |
| SITE 34 | 10/71-12/71 | 84 | .4 | 1.6 | 2.9 | 4.6 | 7.7 | 12.8 | 14.8 | 34.3 | 39.1 | 6.6 | 4.6 | 6.5 | .88 |
| | 1/72- 3/72 | 76 | .1 | .8 | 1.9 | 2.5 | 3.7 | 7.8 | 8.8 | 11.4 | 13.7 | 3.4 | 2.4 | 2.7 | .92 |
| | 4/72- 6/72 | 85 | .3 | .4 | .7 | 1.3 | 2.6 | 4.2 | 6.7 | 15.1 | 16.1 | 2.3 | 1.4 | 2.9 | .97 |
| | 7/71- 6/72 | 335 | BMDL | .6 | 1.6 | 2.5 | 4.2 | 9.2 | 12.6 | 16.2 | 39.1 | 4.0 | 2.5 | 4.5 | 1.04 |
| HARRISON | 7/71- 9/71 | 92 | BMDL | .7 | 1.7 | 2.5 | 3.6 | 5.3 | 6.3 | 8.7 | 9.4 | 2.9 | 2.1 | 1.9 | 1.01 |
| SITE 35 | 10/71-12/71 | 83 | .4 | 1.3 | 2.1 | 3.0 | 4.3 | 7.4 | 9.1 | 13.4 | 16.8 | 3.8 | 3.0 | 2.8 | .71 |
| | 1/72- 3/72 | 85 | BMDL | .7 | 1.3 | 2.0 | 2.9 | 4.9 | 7.3 | 13.4 | 15.6 | 2.7 | 1.8 | 2.6 | 1.05 |
| | 4/72- 6/72 | 84 | .1 | .3 | .8 | 1.3 | 2.2 | 3.6 | 5.4 | 6.9 | 8.1 | 1.8 | 1.2 | 1.6 | .98 |
| | 7/71- 6/72 | 344 | BMDL | .6 | 1.4 | 2.2 | 3.1 | 5.3 | 7.5 | 12.2 | 16.8 | 2.8 | 1.9 | 2.4 | 1.00 |

TABLE 13. CHATTANOOGA NO2 FREQUENCY DISTRIBUTIONS BY SITE.
VALUES GIVEN IN MICROGRAMS PER CUBIC METER.

| | MONTHS | NO. OBS. | MIN | FREQUENCY DISTRIBUTION - PERCENT 10 | 30 | 50 | 70 | 90 | 95 | 99 | MAX | ARITH. MEAN | GEO. MEAN | STD. DEV. | S.D. LOGS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| RED BANK | 7/71- 9/71 | 90 | 17.1 | 24.1 | 32.9 | 39.5 | 44.[illegible] | [illegible] | 61.6 | 68.1 | 81.0 | 39.6 | 37.9 | 11.7 | .30 |
| SITE 41 | 10/71-12/71 | 78 | 10.1 | 22.6 | 33.1 | 40.2 | 51.[illegible] | [illegible] | 72.5 | 96.2 | 137.3 | 43.8 | 39.5 | 20.0 | .48 |
| | 1/72- 3/72 | 78 | 7.8 | 18.7 | 34.5 | 46.1 | 55.1 | [illegible] | 81.6 | 118.5 | 125.4 | 47.7 | 42.2 | 22.9 | .53 |
| | 4/72- 6/72 | 64 | 5.9 | 23.9 | 34.5 | 41.6 | 58.5 | 70.2 | 82.1 | 151.1 | 157.0 | 47.9 | 41.5 | 26.5 | .57 |
| | 7/71- 6/72 | 310 | 5.9 | 23.3 | 33.8 | 41.5 | 50.9 | 68.3 | 77.0 | 124.6 | 157.0 | 44.4 | 40.1 | 20.6 | .47 |
| RED BANK | 7/71- 9/71 | 89 | 20.2 | 27.5 | 35.8 | 39.9 | 48.2 | 61.4 | 77.5 | 111.7 | 127.2 | 44.3 | 41.6 | 17.7 | .35 |
| SITE 42 | 10/71-12/71 | 75 | BMDL | 20.5 | 36.7 | 45.7 | 55.8 | 71.5 | 75.9 | 94.9 | 102.2 | 46.6 | 41.3 | 19.8 | .57 |
| | 1/72- 3/72 | 68 | 10.3 | 24.0 | 37.4 | 48.4 | 61.6 | 71.9 | 81.1 | 84.3 | 84.4 | 48.7 | 44.5 | 19.1 | .46 |
| | 4/72- 6/72 | 79 | BMDL | 22.5 | 37.0 | 47.1 | 58.8 | 77.9 | 104.4 | 152.7 | 183.9 | 51.6 | 44.2 | 28.9 | .61 |
| | 7/71- 6/72 | 311 | BMDL | 23.2 | 36.5 | 44.5 | 55.8 | 72.8 | 82.1 | 117.9 | 183.9 | 47.7 | 42.8 | 21.9 | .50 |
| BRAINERD | 7/71- 9/71 | 89 | 8.1 | 21.8 | 32.4 | 38.7 | 46.1 | 58.3 | 69.3 | 82.5 | 108.4 | 40.1 | 36.6 | 16.5 | .45 |
| SITE 21 | 10/71-12/71 | 81 | BMDL | 19.0 | 31.5 | 43.7 | 57.8 | 73.8 | 75.2 | 88.0 | 121.4 | 44.1 | 38.0 | 21.8 | .61 |
| | 1/72- 3/72 | 79 | 11.1 | 21.1 | 28.6 | 39.5 | 49.7 | 74.1 | 80.0 | 116.0 | 127.0 | 43.5 | 38.1 | 23.2 | .52 |
| | 4/72- 6/72 | 74 | 13.3 | 20.7 | 35.4 | 42.5 | 55.5 | 75.1 | 86.9 | 102.7 | 109.6 | 46.3 | 41.9 | 20.5 | .47 |
| | 7/71- 6/72 | 323 | BMDL | 20.2 | 32.2 | 40.9 | 49.2 | 71.6 | 76.3 | 111.8 | 127.0 | 43.4 | 38.5 | 20.6 | .51 |
| BRAINERD | 7/71- 9/71 | 89 | 16.2 | 36.5 | 46.8 | 54.5 | 64.1 | 81.2 | 90.6 | 108.2 | 117.2 | 57.2 | 54.1 | 18.7 | .35 |
| SITE 22 | 10/71-12/71 | 82 | BMDL | 25.6 | 39.7 | 51.5 | 63.7 | 80.8 | 87.4 | 106.9 | 123.7 | 52.6 | 46.3 | 22.9 | .59 |
| | 1/72- 3/72 | 84 | 10.0 | 25.6 | 40.8 | 48.2 | 64.3 | 85.9 | 98.5 | 139.7 | 152.5 | 54.2 | 48.1 | 26.5 | .51 |
| | 4/72- 6/72 | 75 | 19.7 | 27.6 | 38.8 | 49.4 | 60.1 | 81.1 | 86.6 | 93.1 | 97.1 | 50.7 | 47.0 | 19.5 | .40 |
| | 7/71- 6/72 | 330 | BMDL | 27.3 | 41.2 | 51.6 | 63.6 | 82.7 | 89.1 | 118.8 | 152.5 | 53.8 | 48.9 | 22.2 | .47 |
| HARRISON | 7/71- 9/71 | 87 | 10.2 | 21.3 | 34.4 | 55.0 | 78.7 | 116.1 | 139.5 | 180.0 | 275.7 | 64.4 | 52.3 | 43.2 | .66 |
| SITE 31 | 10/71-12/71 | 84 | BMDL | 13.1 | 37.3 | 56.6 | 78.9 | 127.2 | 146.0 | 179.3 | 187.3 | 64.5 | 47.5 | 44.2 | .91 |
| | 1/72- 3/72 | 85 | 11.2 | 15.8 | 38.0 | 51.9 | 68.0 | 111.3 | 136.5 | 147.7 | 154.5 | 58.4 | 48.0 | 35.3 | .67 |
| | 4/72- 6/72 | 70 | 14.9 | 22.6 | 37.2 | 52.9 | 72.2 | 110.2 | 132.6 | 198.5 | 282.3 | 62.1 | 51.1 | 43.0 | .62 |
| | 7/71- 6/72 | 326 | BMDL | 18.7 | 36.8 | 53.3 | 77.2 | 118.4 | 139.2 | 176.8 | 282.3 | 62.4 | 49.7 | 41.4 | .72 |
| HARRISON | 7/71- 9/71 | 91 | 7.8 | 19.6 | 29.1 | 41.3 | 47.9 | 67.0 | 71.5 | 84.5 | 86.1 | 41.2 | 37.0 | 17.9 | .50 |
| SITE 32 | 10/71-12/71 | 82 | BMDL | 19.0 | 34.3 | 51.0 | 68.7 | 91.6 | 99.2 | 136.2 | 145.4 | 53.2 | 44.0 | 29.3 | .69 |
| | 1/72- 3/72 | 82 | 13.0 | 20.5 | 30.3 | 47.4 | 61.7 | 77.8 | 86.4 | 103.0 | 112.0 | 48.8 | 42.8 | 23.8 | .54 |
| | 4/72- 6/72 | 77 | 12.7 | 23.1 | 32.3 | 40.4 | 49.1 | 70.9 | 82.2 | 96.1 | 110.9 | 44.1 | 40.3 | 19.3 | .43 |
| | 7/71- 6/72 | 332 | BMDL | 20.3 | 32.1 | 43.3 | 56.8 | 77.0 | 86.9 | 111.6 | 145.4 | 46.7 | 40.8 | 23.3 | .55 |
| HARRISON | 7/71- 9/71 | 91 | 14.3 | 19.2 | 24.5 | 31.9 | 38.6 | 47.8 | 60.6 | 87.5 | 94.4 | 33.6 | 31.1 | 14.2 | .39 |
| SITE 33 | 10/71-12/71 | 81 | 7.8 | 23.8 | 38.8 | 47.0 | 59.6 | 81.2 | 97.6 | 115.8 | 120.6 | 51.1 | 45.4 | 23.5 | .53 |
| | 1/72- 3/72 | 86 | 9.8 | 26.9 | 34.7 | 49.1 | 64.4 | 88.6 | 101.1 | 135.0 | 171.5 | 53.3 | 46.9 | 27.8 | .52 |
| | 4/72- 6/72 | 77 | 9.4 | 20.6 | 30.9 | 37.9 | 52.2 | 73.7 | 93.0 | 101.2 | 117.3 | 43.4 | 38.3 | 22.2 | .52 |
| | 7/71- 6/72 | 335 | 7.8 | 20.8 | 31.5 | 39.5 | 50.8 | 77.4 | 94.1 | 118.3 | 171.5 | 45.2 | 39.7 | 23.6 | .51 |
| HARRISON | 7/71- 9/71 | 87 | 6.2 | 15.3 | 20.8 | 26.1 | 37.5 | 52.6 | 61.3 | 73.2 | 123.9 | 31.8 | 27.5 | 18.1 | .56 |
| SITE 34 | 10/71-12/71 | 83 | BMDL | 9.1 | 17.9 | 26.3 | 36.0 | 53.9 | 63.9 | 112.4 | 116.4 | 30.2 | 23.8 | 21.0 | .74 |
| | 1/72- 3/72 | 61 | 5.9 | 12.8 | 20.1 | 26.5 | 34.4 | 46.2 | 57.3 | 69.9 | 71.6 | 28.7 | 24.9 | 14.9 | .56 |
| | 4/72- 6/72 | 77 | 6.8 | 13.9 | 18.3 | 27.6 | 37.0 | 47.8 | 56.1 | 72.4 | 83.5 | 29.2 | 25.7 | 15.6 | .52 |
| | 7/71- 6/72 | 308 | BMDL | 11.7 | 19.2 | 26.4 | 36.2 | 52.0 | 60.9 | 83.1 | 123.9 | 30.1 | 25.5 | 17.6 | .60 |
| HARRISON | 7/71- 9/71 | 82 | 7.3 | 21.0 | 31.0 | 45.2 | 57.0 | 73.9 | 83.6 | 102.2 | 133.1 | 46.5 | 40.9 | 22.5 | .55 |
| SITE 35 | 10/71-12/71 | 83 | BMDL | 11.1 | 27.3 | 37.0 | 49.2 | 71.2 | 78.6 | 96.3 | 121.0 | 39.4 | 31.9 | 23.0 | .73 |
| | 1/72- 3/72 | 86 | 9.8 | 15.4 | 25.2 | 36.3 | 48.6 | 61.2 | 71.5 | 92.8 | 98.2 | 38.0 | 33.1 | 19.2 | .55 |
| | 4/72- 6/72 | 79 | 10.7 | 17.3 | 25.1 | 34.3 | 47.3 | 56.8 | 70.0 | 99.7 | 128.1 | 38.1 | 33.6 | 20.1 | .51 |
| | 7/71- 6/72 | 330 | BMDL | 16.0 | 26.6 | 38.2 | 49.8 | 69.0 | 78.2 | 97.3 | 133.1 | 40.5 | 34.7 | 21.4 | .60 |

Table 14. Annual Pollutant Means ($\mu g/m^3$) from CHESS for 1970 to 1973

TSP
geometric mean

| | Red Bank | | Brainerd | | Harrison | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Site | 41 | 42 | 21 | 22 | 31 | 32 | 33 | 34 | 35 |
| 1970[a] | 70.0 | 58.8 | 64.9 | 61.9 | 55.0 | 55.2 | 51.0 | 40.6 | 51.5 |
| 1971 | 68.5 | 59.1 | 66.4 | 57.5 | 55.9 | 55.6 | 50.8 | 42.2 | 55.1 |
| 1972 | 70.0 | 66.6 | 65.1 | 59.0 | 53.7 | 53.2 | 49.6 | 43.5 | 54.3 |

Sulfate Fraction
arithmetic mean

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1970[a] | 13.4 | 12.0 | 12.7 | 12.3 | 13.0 | 12.2 | 12.4 | 12.6 | 12.9 |
| 1971 | 10.3 | 9.3 | 9.7 | 9.4 | 9.6 | 10.1 | 9.8 | 9.7 | 10.3 |
| 1972 | 11.1 | 11.1 | 11.3 | 10.6 | 11.1 | 9.8 | 11.1 | 11.7 | 10.7 |

Nitrate Fraction
arithmetic mean

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1970[a] | 1.2 | 1.0 | 2.0 | 1.4 | 8.4 | 1.8 | 2.1 | 2.0 | 1.7 |
| 1971 | 2.4 | 2.0 | 3.1 | 3.0 | 12.9 | 4.1 | 4.8 | 4.6 | 3.2 |
| 1972 | 1.1 | 1.1 | 1.6 | 1.5 | 7.1 | 2.3 | 2.5 | 2.0 | 1.7 |

$NO_2$
arithmetic mean

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| 1970[a] | 57.9 | 58.9 | 62.3 | 80.5 | 142.7 | 65.1 | 67.7 | 53.8 | 55.3 |
| 1971 | 41.9 | 47.2 | 44.5 | 56.9 | 73.8 | 47.9 | 46.5 | 33.1 | 42.2 |
| 1972 | 40.8 | 43.9 | 40.9 | 47.7 | 61.6 | 42.0 | 43.0 | 30.2 | 35.8 |

[a] June through December values only.

Table 15. Height, Age, Machine, and Symptom Adjusted Mean $FEV_{0.75}$ Distributed by Community and by Season

Age < 108 Months

| Community | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | Winter | Spring | Average | Winter | Spring | Average |
| Red Bank | 1.313 (329)[a] | 1.340 (308) | 1.334 (298) | 1.187 (315) | 1.211 (298) | 1.204 (288) |
| Brainerd | 1.300 (267) | 1.308 (268) | 1.311 (260) | 1.173 (248) | 1.193 (251) | 1.185 (234) |
| Harrison | 1.286 (376) | 1.368 (368) | 1.331 (351) | 1.202 (347) | 1.261 (342) | 1.237 (315) |

Age ≥ 108 Months

| Community | Males | | | Females | | |
|---|---|---|---|---|---|---|
| | Winter | Spring | Average | Winter | Spring | Average |
| Red Bank | 1.824 (513) | 1.848 (507) | 1.835 (494) | 1.745 (446) | 1.764 (443) | 1.755 (424) |
| Brainerd | 1.810 (358) | 1.807 (351) | 1.806 (336) | 1.734 (345) | 1.761 (345) | 1.747 (325) |
| Harrison | 1.797 (439) | 1.861 (432) | 1.826 (413) | 1.706 (355) | 1.781 (360) | 1.751 (331) |

[a] ( ) indicates sample size for that mean.

Table 16. F Values for Analysis of Variance, Distributed by Season and by Sex

| Factor | D.F.[a] | Winter | Spring | Average |
|---|---|---|---|---|
| Males < 108 Months | | | | |
| Height | 1 | 353.39*** | 391.57*** | 457.30*** |
| Age | 1 | 23.76*** | 15.50*** | 19.02*** |
| Machines | 1 | 1.34 | 11.30*** | |
| Symptom | 1 | 7.61** | .05 | |
| Community | 2 | 1.69 | 7.41** | 1.49 |
| Females < 108 Months | | | | |
| Height | 1 | 343.89*** | 352.58*** | 409.30*** |
| Age | 1 | 12.47*** | 16.55*** | 13.56*** |
| Machines | 1 | .20 | 1.11 | |
| Symptom | 1 | 1.40 | 2.58 | |
| Community | 2 | 1.93 | 12.63*** | 8.11*** |
| Males ≥ 108 Months | | | | |
| Height | 1 | 730.75*** | 853.27*** | 905.44*** |
| Age | 1 | 38.31*** | 7.89** | 12.82*** |
| Machines | 1 | 16.47*** | 3.84 | |
| Symptom | 1 | 3.54 | .67 | |
| Community | 2 | 1.69 | 5.97** | 1.94 |
| Females ≥ 108 Months | | | | |
| Height | 1 | 757.39*** | 867.61*** | 979.28*** |
| Age | 1 | 36.98*** | 2.18 | 10.08** |
| Machines | 1 | 3.00 | 11.16*** | |
| Symptom | 1 | 2.91 | 12.71*** | |
| Community | 2 | 2.80 | 0.76 | 0.14 |

[a] Degrees of freedom of the numerator. The degrees of freedom for the denominator are given in Table 17.

* $p < 0.05$
** $p < 0.01$
*** $p < 0.001$

Table 17. Height, Age, Machine, and Community Adjusted Mean $FEV_{0.75}$ Distributed by Symptoms and Season

Age < 108 Months

| | Males | | Females | |
|---|---|---|---|---|
| | Winter | Spring | Winter | Spring |
| No Symptoms | 1.310 (694) | 1.343 (776) | 1.196 (576) | 1.220 (676) |
| Symptoms | 1.272 (278) | 1.339 (168) | 1.180 (334) | 1.242 (215) |

Age ≥ 108 Months

| | Males | | Females | |
|---|---|---|---|---|
| | Winter | Spring | Winter | Spring |
| No Symptoms | 1.817 (1061) | 1.843 (1143) | 1.737 (815) | 1.781 (914) |
| Symptoms | 1.787 (249) | 1.827 (147) | 1.711 (331) | 1.719 (234) |

Table 18. Regression Coefficients for Height and Age Distributed by Sex and Age

| | Regression Coefficients | | |
|---|---|---|---|
| | Winter | Spring | Average |
| Males < 108 months | | | |
| Height (liters/inch) | .0538 | .0614 | .0603 |
| Age (liters/month) | .0040 | .0034 | .0034 |
| Females < 108 months | | | |
| Height (liters/inch) | .0522 | .0539 | .0542 |
| Age (liters/month) | .0028 | .0033 | .0028 |
| Males ≥ 108 months | | | |
| Height (liters/inch) | .0619 | .0725 | .0707 |
| Age (liters/month) | .0038 | .0018 | .0021 |
| Females ≥ 108 months | | | |
| Height (liters/inch) | .0661 | .0740 | .0724 |
| Age (liters/month) | .0045 | .0011 | .0022 |

Table 19. Mean Heights and Ages of Those in the Analysis, by Sex and Age

| | Winter | Spring | Average |
|---|---|---|---|
| Males < 108 months | | | |
| Height (inches) | 50.297 | 50.623 | 50.501 |
| Age (months) | 91.702 | 93.975 | 92.970 |
| Females < 108 months | | | |
| Height | 49.968 | 50.191 | 50.110 |
| Age | 91.467 | 93.629 | 92.658 |
| Males ≥ 108 months | | | |
| Height | 56.609 | 56.750 | 56.659 |
| Age | 127.743 | 129.689 | 128.628 |
| Females ≥ 108 months | | | |
| Height | 56.906 | 57.072 | 57.027 |
| Age | 127.482 | 129.287 | 128.331 |

Table 20. Mean Square Error of FEV Analyses By Season

| Age-Sex Group | Winter | Spring | Average |
|---|---|---|---|
| Males < 108 Months | .0361 (965)[a] | .0378 (937) | .0300 (904) |
| Females < 108 Months | .0309 (903) | .0300 (884) | .0243 (832) |
| Males ≥ 108 Months | .0483 (1303) | .0501 (1283) | .0425 (1238) |
| Females ≥108 Months | .0538 (1139) | .0543 (1141) | .0433 (1075) |

[a] ( ) indicates degrees of freedom.